NUI Galway
OÉ Gaillimh

Autumn Examinations 2014/ 2015

Exam Code(s)	4BCT1
Exam(s)	4th Year Examination Computing Science and IT
Module Code(s)	CT421
Module(s)	Artificial Intelligence
Paper No.	1
Repeat Paper	No
External Examiner(s)	Professor Liam Maguire
Internal Examiner(s)	Professor G Lyons Dr. M Madden *Dr. C Mulvihill *Dr. F Smith

Instructions: Answer 2 questions from each section. All questions will be marked equally. Use a separate answer book for each section.

Duration	2 hours
No. of Pages	5
Discipline(s)	IT
Course Co-ordinator(s)	

Requirements:

MCQ	Release to Library: Yes ☐ No ☐
Handout	None
Statistical/ Log Tables	None
Cambridge Tables	None
Graph Paper	None
Log Graph Paper	None
Other Materials	None
Graphic material in colour	Yes ☐ No ☐

PTO

Section A

1

(a)

What are the advantages of Fuzzy Logic over conventional ‘Crisp Logic’? When would it be suitable to use Fuzzy Logic? (10 marks)

(b)

Does absolute truth exist in fuzzy logic? Explain your answer. (5 marks)

(d)

Describe the steps used in fuzzy rule based systems. (5 marks)

(e)

Consider the assertion “Boolean logic is just a special case of fuzzy logic”. Do you think this is true? Explain your answer. (5 marks)

PTO

2

a) Suppose you had a QSIM Simulation of a mass on a spring. You now want to model a similar system with a different spring and a different mass. What changes would you need to make to your model?
(4 marks)

b) What are the advantages and disadvantages of Qualitative Reasoning?
(6 marks)

c) Given the following constraints (which represent the motion of a ball being thrown in the air):

DERIV(x , v)
DERIV(v , a)
a = g < 0

and the quantity spaces:
{ -∞, 0, ∞} for v
{ 0, top } for x

If the initial state is:
$QS(x,t_1)$=<top,std>
$QS(v,t_1)$=<0,dec>
$QS(a,t_1)$=<g,std>

What are the possible next states? (Show your workings)

Rule-id	$QS(v,t_i)$	$QS(v,t_i,t_{i+1})$
P1	$<l_i$,std>	$<l_i$,std>
P2	$<l_i$,std>	$<(l_i,l_{i+1})$,inc>
P3	$<l_i$,std>	$<(l_{i-1},l_i)$,dec>
P4	$<l_i$,inc>	$<(l_i,l_{i+1})$,inc>
P5	$<(l_i,l_{i+1})$,inc>	$<(l_i,l_{i+1})$,inc>
P6	$<l_i$,dec>	$<(l_{i-1},l_i)$,dec>
P7	$<(l_i,l_{i+1})$,dec>	$<(l_i,l_{i+1})$,dec>

(10 marks)

d) What conditions allow QSIM to generate multiple possible behaviours?
(5 marks)

PTO

3

(a)

How does AI search differ from searches that are applied to data structures? (5 marks)

(b)

Describe both forward chaining and backward chaining, give examples of situations when each technique would be suitable. (10 marks)

(c)

Why would you want to use both forward and backward chaining at the same time. Would it be more or less efficient to do so? (10 marks)

PTO

Section B

4

(a) Give your understanding of the term ‘greedy algorithm’ (5 marks)

(b) Consider a machine that dispenses change using a greedy algorithm. If the change required is 50, and the coins available are 1,5,10, and 20, state what coins will be dispensed. If the change required is 40 and the coins available are 25, 10 and 1, state what will happen. Is this the best that could be done if the aim is to minimise the number of coins in the change? (10 marks)

(c) Consider the following graph. A and E are connected by an edge. A and F are also connected by an edge. B and D are connected. B and F are connected. C and D are connected. C and E are connected. Suppose that a colouring of the edges is required where no two edges that meet at a common vertex may have the same colour. Thus in the graph under consideration, the edge connecting A and E and the edge connecting E and C (for example) may not be coloured the same. Given the edge ordering AE, EC, CD, DB, BF, FA, how many colours will a greedy algorithm use? Can you find an ordering for the edges where at least three colours are needed by a greedy algorithm? (10 marks)

5

(a) In the context of genetic algorithms, explain what is meant by the term ‘fitness function’ (5 marks)

(b) A genetic algorithm is required for navigating in a simple two-dimensional maze. Allowed moves are north, south, east and west. There is an entrance in the south-east and an exit in the north-west. Explain how you would construct chromosomes and also a fitness function for such an algorithm. (10 marks)

(c) A student is developing a genetic algorithm for the travelling salesman problem for fifty cities. The student is considering a simple mutation operator that allows any city (as represented by an integer such as 10) mutate into any other city (as represented by an integer such as 24). Advise the student on any one problem with this approach to mutation in this context. (10 marks)

6

“Artificial Intelligence is very important for the future of computing” Discuss this statement. (25 marks)